



So you want to start a pirate radio station...

Authors note. this was written over a year ago. and many things are out of date. though enough is still useful that I continue to distribute it, a revision will come out soon. The most noticeable error is that Radio Mutiny is now off the air, confiscated by the FCC in late April. We told them that if they shut us down, ten more stations would open in our place. A transmitter in your hands is worth 200 channels worth of mush!

Pete triDish

We don't have any radio engineers here at Radio Mutiny, but we do have a fully functioning microbroadcasting station. Lot's of people have been asking us how to get started, so I've written this quick description of our basic set up Keep in mind that our station is by no means the best set up available: it's the best thing that our group of fairly ordinary folks have managed to assemble over the course of a year and a half of confused accumulation.

Before you read further I'd like to make two quick observations: if you've read some nonsense somewhere that you can make a radio station out of an old clock radio, some bobby pins and a capacitor or two from radio shack, you can just forget it. You are going to need some money to pull this off. The transmitter and amplifier themselves only add up to around \$300, but there are many other expenses and you will need the vast majority of the transmitter associated equipment before you get started. You will need the following to get started: this list includes all of the synonyms that people use for these pieces of equipment, which can lead to some confusion in itself (I also threw in approximate prices for these things)

- Exciter/PLL/ transmitter: \$125 - 200, depending whether you buy as a kit or preassembled
- Amp/ amplifier: \$100 - 200, depending on it's output and whether it's preassembled
- Power supply: \$60 - 80
- SWR meter/reflectometer/power meter: \$60 - 100
- antenna \$60 - 120 for a commercial one, which I strongly suggest
- Dummy Load: \$10 for a Berkeley kit which you can use for a few minutes at a time, \$30 for a good one
- Compressor: \$50 - 200
- Coaxial Cable 60¢ - \$1.00 per foot
- Cooling fans, connectors, patch cables, and so on: much can be scrounged, but you'll spend \$50 to \$100.

This list is just the transmitter side of things, I'm not even talking about the studio, with a mixer, turntables, cassette decks, a phone line, headphones, mics and so on. These things tend to come for free, because they are ubiquitous consumer electronics which people will donate to you. Beware though, that these things will break and you will need to find some nerd to be part of your project to sit around fixing these things as they constantly conk out.

My second observation is that this technical stuff, difficult as it can be, is by far the easy part of running a pirate station. To pull this off, you need to have endless time, a solid group of committed people who trust each other, a unifying mission for the participants in the project and a powerful bullshit detector. Obviously one size does not fit all in these more social kinds of challenges, but it is our experience that a tight, well planned, democratic structure is essential. In the future we will put out documents on organization, programming policies and so on to give aspiring stations ideas about how to handle these more challenging questions (perhaps once we've figured it out better for ourselves), but for now we will stick to technical aspects.

This is what we've got:

Exciter/PLL/Transmitter: Free Radio Berkeley Phase Locked Loop, 1/2 watt output. Lots of folks in the market for transmitters slag Dunifer and FRB. FRB has certainly had it's share of problems: court actions, internal strife, lack of volunteers, and so on, and this has interfered with their ability to reliably put out a good product in the past. They have at times had serious trouble getting parts that they needed from suppliers and sat on people's money for months at a time. Dunifer is not always great at dealing with the public, and can be hard to reach. He certainly doesn't have any money to return your phone calls. They have taken some great strides in the past year, and their line of products is always improving. While the assembly and documentation was a bit hellish when we bought Our exciter, it has been very reliable and withstood a fair amount of abuse. We do still occasionally get weird hums and howling noises on our broadcasted audio, but I'm not sure if the root of our problem is at the transmitter. Another problem we have is some mild frequency drift- occasionally it will float out of tune as it warms up, and will need adjustment. Free Radio Berkeley is well worth supporting with your money, as they are at the frontlines of the Free Radio struggle. One good option is to buy their

products from **LD Brewer**, who retails them and is better set up to provide technical support to customers. Free Radio Berkeley still gets a lot of money when you purchase from Brewer, and it saves Berkeley the frustration of having to answer your dumb questions.

Our back up transmitter is a **Panaxis FMX**. The circuit board seems better designed for assembly by an amateur- it has fewer clusters of very fine solder traces. It's very easy for blockheads like me to manage to accidentally create a solder bridge between those small traces on the **FRB PLL board**. The documentation is more clearly written than the Berkeley instructions, though Berkeley's instructions have definitely improved since I had to use them. Incidentally, the main reason for some of the lack of clarity in the Berkeley product documentation is that they are making constant improvements in transmitter design and have to change their kits frequently as a result of component availability.

Anyway, **Panaxis** seems to be the transmitter that most people are recommending these days, and I like it, but I do have a few caveats. I personally can't see how Panaxis or FRB are clearly better than one another.

One caveat is that it only puts out about half the wattage of the Berkeley Exciter (FMX, 200-300 milliwatts, FRB 500-800 milliwatts. If you are using it standing alone, without an amp, that's a big difference. There also seems to be a proportionately smaller but still significant difference in how they drive an amp. Driving the FRB 20 watt amp, I've gotten as much as 18 watts from the FMX, and 23 watts from the FRB PLL.

The other caution with **Panaxis** is to read the instructions carefully. They have provided an array of circuit options for their kit having to do with its legal use and what kind of audio input you want. It's not too difficult if you are a bonehead like me to solder in a bunch of extra components and cause the thing to perform poorly. Solder from the instructions, not from the component list!

Everyone is talking about how great the **Broadcast Warehouse** and **Veronica** transmitters are- I have no experience with them, but I've only heard rave reviews and no complaints yet. They are available in the States through LD Brewer.

Stereo Vs. Mono. Our transmitter is mono. A stereo generator is around \$100, and it's nice to have stereo, but it will effectively reduce your broadcasting power by half, so you will have a dramatically smaller coverage. I prefer to get the signal out further.

Amplifier - **FRB 20 watt**. This amplifier has almost all of its circuitry in a single power module, and requires no tuning. It's an all around great little amp, and I heartily recommend it. The one thing that you should never do is hook up the power backwards. Reverse polarity will

instantly and irrevocably destroy this amplifier and you will have to buy a new power module (BGY33) which costs about \$75. These power modules are sometimes hard to come by. I've waited three months for one when I blew mine up. I think availability is better now, but do yourself a favor and don't hook it up backwards. It is definably a design flaw of the amplifier that it allows you to do this, a polarized connector or a blocking diode should be included, but it is not. The signal that our station puts out with this amp has been heard 15 miles away (using a fancy receiving antenna), and covers an area much larger than we really anticipated when we started. The amplifier includes a filter, so you do not need to purchase one.

Another option is the **FRB 40 watt amp**. It requires a fairly delicate turning procedure for which there are no well written instructions. I've heard that the ones they are selling now have a much simpler circuit, with just two variable capacitors rather than the ten that are in the one that I bought. Obviously, it's more powerful, but I've generally been content with the results of our 20 watt amp. This amplifier needs to be used with a separate filter. You can use the **9 pole filter kit** from FRB for \$25, +\$15 for an enclosure. It hasn't worked well for me- it puts out a lot of heat and decreases the power output significantly. Another filter option is the **Progressive Concepts Filter**, available through LD Brewer for around \$70.

All amps that I know about need a fan pointed at them to keep them *cooled off!* Make the air flow through the fins, dissipate the heat. The instructions never seem to mention this/ do it anyway. A twelve volt, 4 inch muffin fan from radio shack or scavenged out of an old computer will do just fine. I aim one at the 12 amp power supply that I use to power everything as well.

A word about wattage: People often ask me how far 20 watts, or a half watt, or a hundred watts can go, and I always answer 'who knows'? Wattage is a secondary factor in microbroadcasting. The most important factor is whether your broadcasting antenna can "see" the receiving antenna. The higher your antenna is, the more it can see. In Dunifer's microbroadcasting primer, he gives rough approximations of distances that different wattages can reach, but it's important to remember that these are for good tuners that are unobstructed. More power will allow you to penetrate deeper through concrete and steel and wood, into people's homes and onto their stereos, and will cause more bouncing waves that can bring the signal into places that can't actually "see" the broadcast antenna. Your first priority, though, is to get that antenna high up. Ham stores and radio shack offer antenna poles of various kinds- we have 20' of antenna pole and some guy wires. We are fortunate enough to have a location on top of a hill. If I had it to do again, I might try one of those 36' telescoping antenna poles from radio shack.

SWR Meter - You absolutely need one of these! And don't get a cheap one, or one from radio shack, they won't work on your frequency. LD Brewer and Dunifer sell them. You probably want one with two needles, one for forward power and one for backward power. I had a cheap one that didn't work for shit. Dunifer sells a cheap one for \$35, I don't know how well it works. The **Daiwa 2 Needle** ones are around \$100, they definitely work and you will use it more than you think.

A word about **connectors**: Nothing will create more misery for you than bad connectors. All your audio will probably go over patch cords with rca phone plugs. Out of the dozens of these that you will be using, 3 or 4 will always be intermittent and you'll be jiggling them to make them work. You can tighten them up a bit by squeezing the outside conductor if it is slotted, so it grips the female receptacle better. You can pad the inner conductor with a bit of solder to make it tighter. Weird hums hisses, whines, or intermittent audio is often caused by these loose connections . A place that I've had some real dumb-ass problems is power connections. I used to have all my power hooked up McGuyver style with alligator clips on bare copper bus bars! Thought: what the hell, as long as the power is getting there, who cares. Problem was, everytime a door slammed shut or a truck went by on the street, these connections would wriggle and the radio would go off for a split second. Now I have a terminal strip with screws and crimped spade connectors, it's much more reliable. Banana plugs that come with the FRB are also very vulnerable, if they are loose, the current can arc from plug to receptacle and eat as much of half of your power in the process. Take a dental pick and spread out the male banana conductor so it takes up more room in the receptacle to remedy this, if you suspect a bad connection. If you can wiggle it, and the power goes on and off, it's too loose.

Coaxial cable: Don't bother with the 58 or 59 cable. Get big fat stuff. Ours is RG8/U bought at a ham store by the foot. You want to keep your coaxial cable as short as possible, but leave a little room so that you can move the transmitter around a little bit if you need to. Measure carefully, it's expensive and you'll lose more power by having to stick a connector in line than by having a few spare feet of cable.

Audio feed cable is important too. I used an old piece of phone wire to bring the audio signal from the studio to the transmitter, but I changed it to shielded cable because it was picking up a lot of interference from AM radio stations.

Antennas: I've had lousy luck with the FRB home made antennas. I've never gotten one to work well. I've only really tried the slim jim. It had a design flaw in that it calls for copper tubing and steel hose clamps. These dissimilar metals corrode quickly when touching and exposed to the elements, eventually leading to a bad

connection. Next time, I'm going to try the **groundplane antenna design**. I've tried 3 times to build a slim jim and the swr was always too high. The most important thing with most antennas is their height above the roof. For this, you should look at the full array of antenna mounting options at your local Ham Radio supply store, or radio shack. Radio shack has a really nice telescoping antenna pole that goes up 36 feet for about 60 dollars though it does need guy wires. I have not seen a station yet that did not need to be at least 20 feet off the roof. The bottom of your antenna must be at least 12 feet off your roof, and the more the better.

If you want a low profile antenna that does not have to be so high above your roof, you might try a **yagi antenna design**. These are directional antennas, so they will only send out your signal in certain directions, this may be a good thing, depending on your desired coverage. I have no experience with these. I've had much better luck with a commercial antenna. The **Comet antenna** goes for about \$110 and it kicks ass- well built, weather resistant. lots of gain. One caution is that the bolts need to be tight when you put it together, I've seen these poorly assembled and it can fry your transmitter if these are not put together snugly.

Free Radio Berkeley has a real good deal for an '**on the air quick**' package. It's \$595 for most of what you need- you'll also need a dummy load and a tweak stick, and also some coaxial cable. With FRB, you can't expect a lot of tech support, and it may take a few months before they get your order. Don't freak out, they're not stealing your money and going to Cuba. It just takes time. They respond best to email, or if you catch them on the phone. They do need a little bit of civil pestering at times. but being rude will get you nowhere. They won't return your calls it's not personal- they can't afford it. They are at frbspd@crl.com, or www.freeradio.org., or 1442A Walnut Street #406 Berkeley, CA, 94709.

LDBrewer is at 800-886-8023 6610-D Fowler Ave., Tampa, FL 33617 <http://www.ldbrewer.com>

They are very helpful over the phone, and send things out quickly, and keep up their stock. Their '**on the air quick**' package is more expensive, but is fully assembled. It includes a panaxis exciter, FRB amp, and a stereo generator. Obviously, it will not go out as far. You will need a lot of other stuff that's not included; an SWR meter, power supply, antenna, dummy load, coaxial cable. That will add up to quite a bit more money than Free Radio Berkeley, but it will come quickly and they'll answer your questions.

Other equipment suppliers

Panaxis: P.O. Box 130, Paradise, CA, 95967
916-534-0417

Ramsey: 793 Canning Parkway, Victor, NY 14564
716-924-4560

If you got this from me. you may have also gotten Dunifer's primer. Read the whole thing! Twice! Three times. You will understand. eventually. I don't know of anything better, at the moment. You will have many problems along the way and you will hear many contradictory reports about how to do things. You will ignore good advice on occasion and screw things up. At times/ you will be able to get advice from no one and you will just have to guess. You will probably blow some of your equipment up, on occasion, and need to buy new stuff. If this list of disasters hasn't deterred you, you're ready to take to the airwaves. Good luck. All novice pirates are welcome to call us at Radio Mutiny for free mediocre advice. You can call LD Brewer for free good advice, but I try not to over burden them until I'm stumped.

Feel free to send me email at
pete_tridish@hotmail.com I'll answer any questions to whatever extent I can... Good Luck!!!

Microradio Resources On the Web:

These links will put you in touch with equipment providers, policy updates and movement news.

Radio4All has good links, current micropower radio movement news and up to date action alerts.
<http://radio4all.org>

Free Radio Berkeley
<http://www.freeradio.org/>

LD Brewer
<http://ldbrewer.com>

Free Radio Network
<http://www.frn.net>

New York Free Media Alliance - local area micro radio news and the legal briefs of Free Speech vs. the FCC.
<http://artcon.rutgers.edu/papertiger/nyfma>

Prometheus Radio Project
<http://home.earthlink.net/~prometheusrp/>

Low power Radio FAQ (very helpful for beginners).
<http://www.frn.net/special/prsg/>

The Official Pirate Radio Kit Bulletin Board
An excellent site for comparing and contrasting the various brand's and sources of transmitters.
<http://members.tripod.com/~transmitters/>

Beginners guide to low power broadcasting
by Rick Harrison
<http://www.freespeech.org/lowpower/guide.html>

Government - FCC both the mass media bureau and the hot topics page have interesting stuff. The FCC also has a site devoted to Low Power FM with info on the Notice of Proposed Rulemaking.
<http://www.fcc.gov>
<http://www.fcc.gov/mmb/prd/lpfm/>

Roger Skinner's webpage author of the most technically oriented petition for lpfm
<http://www.concentric.net/Radiotv/>

"Radio Is My Bomb" the English pirate handbook
<http://www.irational.org/sic/radio>

Americans for Radio Diversity
<http://www.radiodiversity.com>

To find a free frequency, use
<http://www.airwaves.com/fccdb.html> or
<http://wmbr.mit.edu/stations/locate.html>

To find licensed stations in your area
<http://www.airwaves.com/fmdb.html>

The Prometheus Radio Project



Returning the Radio Airwaves to the People